



## Oral health of schoolchildren in rural Vietnam

### Part IV. High early childhood caries experience in preschool-aged children

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#### Abstract

**Background:** This is the fourth report on oral hygiene, dietary habits and dental caries of schoolchildren in several rural villages in Vietnam, conducted in conjunction with the Rotary Australia Vietnam Dental Health (RAVDH) Project, a humanitarian aid project which provides limited dental services, oral health promotion, and continuing education to local dentists. **Materials and Methods:** In 2010, parents or teachers of 208 children aged 2-5 years attending kindergartens in the villages of Tan Hiep and Phu Giao completed a questionnaire addressing their oral hygiene habits, and consumption of sweet drinks, sweet foods, and water. They were also examined clinically, recording their dmft scores and plaque on maxillary central incisors. **Results:** A very high dental caries experience was found; the prevalence was 93% and the mean ( $\pm$  SD) dmft was 6.6 (4.5). In 70% of dentitions the maxillary incisors and/or cuspids were carious (dmft:  $8.0 \pm 4.2$ ); in 82% of dentitions the maxillary and/or mandibular molars were carious (dmft:  $7.7 \pm 4.1$ ); the highest dmft ( $9.1 \pm 3.7$ ) was seen in dentitions with caries on both anterior and posterior teeth. The prevalence of anterior plus posterior caries in those reporting no intake or once/day intakes of sweet drinks (60-62%) was similar to those reporting three or more intakes/day (67%). Frequency and timing of toothbrushing had no effect on plaque accumulation. Only 8% of children were plaque-free on the labial surfaces of index teeth; plaque was present on the gingival one-third for 22%, on the gingival and middle one-thirds for 45%, and on the gingival, middle and incisal one-thirds for 11% of children. **Conclusions:** Corroborating the previous studies, this study again highlights the urgent need to address oral health of children in these villages in rural Vietnam. Oral health programs directed towards families and teachers must be introduced for all children to promote effective oral hygiene, moderation of dietary sugar intake, delivery of dental care, and appropriate use of fluoride modalities.

#### Introduction

##### The Rotary Australia Vietnam Dental Health (RAVDH) Project

The humanitarian aid Rotary Australia Vietnam Dental Health (RAVDH) Project has been reviewed previously in this series of papers.<sup>1-3</sup> Since 2004 this Project has provided limited dental services to children from several rural schools in the villages of Vi Thanh (Hau Giang Province), Ben Cau (Tay Ninh Province), Tan Hiep (Kien Giang Province) and Phu Giao (Binh Duong Province) in Southern Vietnam. The Project aims to improve the oral health of groups of schoolchildren in these villages by promoting oral health, assessing the impact of Project visits, and by providing continuing dental education and support to local dentists. The Project has supported the development of basic dental equipment in dental clinics and school-based tooth brushing programs in these schools.

The oral health of 389 rural schoolchildren aged 11-16 years in these villages was studied in association with three RAVDH Project visits (2007-09), recording oral hygiene practices, dietary habits, drinking water and dental caries experience.<sup>1-3</sup> The prevalence of caries was very high, affecting 94-96% (mean DMFT  $4.1 \pm 2.4$ ) of children.<sup>1-3</sup> Mean DMFT scores were consistently higher when sweet drinks were consumed three or more times per day in comparison with twice per day, and mean DMFT scores increased with increasing frequency of daily consumption of sweet drinks plus sweet foods.<sup>3</sup> An abundant supply of inexpensive sweet drinks and sweet

THIS ISSUE



## President's Report

Kareen Mekertichian

**By the time of reading this edition of Synopses, Easter and Holiday celebrations together with ANZAC Day commemorations have already past and we are almost getting to the middle of another busy year.... where did that go ?**

Since our last edition, it seems like the disasters facing our colleagues and the Earth itself have been escalating. I have been in contact with many of our members affected by the tragic events of the Queensland floods and the horrific aftermath of the Christchurch earthquakes – passing on our Society's best wishes, thoughts and heartfelt condolences. These regions continue to struggle as they rebuild and heroically battle-on in the face of extreme hardship, sadness and uncertainty and we pay our respects to all those involved.

### Forthcoming Events

Time is drawing closer to the forthcoming RK Hall Travelling Lecture Tour – proudly Sponsored by Colgate – to be held in Uluru 24th-28th August. The local organising team under the guidance of Dr Joe Verco has put together a wonderful programme in a truly inspirational location. I urge all our members to consider attending this unique event and further details can be found via the conference website [[www.themeetingpeople.com.au/anzspd-home](http://www.themeetingpeople.com.au/anzspd-home)].

Another very exciting event is the IAPD Congress which will be held in Athens (15th – 18th June) at which time Dr Eduardo Alcaino will be inducted as the next IAPD President. This is not only a wonderful recognition of the hard work Eduardo has provided to the IAPD over many years but a great watermark point for ANZSPD in our international advocacy. Our Society has been intimately involved in support of this Congress and establishing a precedent by arranging to sponsor an entire pre-Congress Seminar. This hands-on workshop (Basic Paediatric Dentistry – Clinical Procedures) will be an ANZSPD-Greek collaboration under the direct supervision of A/ Professor Richard Widmer and Dr Peter

Gregory – with the help and support of several of our ANZSPD members. This is the first time in the history of IAPD that such support for a Congress has been directly given by a member nation and we should all be very proud of the wonderful legacy we are establishing in the global arena. I know that a very large and enthusiastic team of ANZSPD members are planning a visit to the Greek Isles to help in the celebration of this fantastic event and I urge all of you to consider a mid-winter trip to the Aegean if possible [[www.iapd2011.org](http://www.iapd2011.org)].

The next ANZSPD Biennial meeting is to be held in winter (June-July) of 2012 under the local organisational banner of the NSW Division. The venue for the Conference is to be in the beautiful ACT – allowing an opportunity to combine an exciting scientific programme together with access to the winter wonderland of the nation's Capital. Planning is well under way and further information will be made available soon.

### WA Update

Along with his ongoing role with ANZSPD, Dr Alistair Devlin has been very busy during his "retirement" from dental practice, coordinating the University of WA undergraduate Paediatric Dentistry course. Alistair is providing his usual style of passion, expertise and good humour to energise the students. An exciting edition also to the University of WA is the recent appointment of Professor Nigel King, formally from Hong Kong as Head of Department of Paediatric Dentistry commencing later this year. Nigel is well known to our Society and has been actively involved within the AAPD for many years, recently re-appointed as President. Nigel's immense skills and partnership with the current WA team will ensure continuation of world class teaching within our discipline, already

so highly regarded across the dental schools of ANZ and the Asia-Pacific.

### Adolescent Smoking

I was chatting to an orderly at the hospital I attend for my GA work, a young man of 19 years spending University holiday time earning a little extra cash. He was starting an afternoon shift after lunch and was finishing his fourth cigarette of the day as I arrived into the car park. He was quite distressed at the price of cigarettes which can range from A\$18-20 depending on the brand. I was intrigued by not only the financial cost but the whole culture of adolescent smoking and its implications to oral and systemic health.

Some interesting Australian statistics from the Cancer Council of NSW :

- In 2007 – the daily smoking rate in NSW for adult men 18% and women 15%
- The highest rates of daily smoking among Australian men were in the 18-24 years age group (34%) and for women in the 25-34 years age group (27%)
- In 2005 – smoking rates for Australian secondary students (12-17 years) was 9% in boys and 10% in girls
- These figures peaked at 19% for boys and 17% for girls at 17 years
- Very few people start smoking or become habitual smokers after their teenage years and approximately half of all long-term smokers will die as a result of their smoking

The overall consensus is that people who start to smoke at an early age are most likely to smoke heavily, to become more nicotine dependent and will be at a greater risk of smoking-related illness or death. The statistics are very chilling and disheartening and yet, our battle

with smoking remains to be a health policy struggle, much like many other initiatives with respect to obesity, heart disease and caries.

The link between smoking and periodontal disease in adults has been quite well documented although the adolescent pattern remains poorly understood. In adult smokers - greater loss of periodontal bone height, deeper probing depths, more severe and refractory periodontal disease – all appear to be strongly linked. An interesting Finnish article on adolescent smoking and oral health was published by Heikkinen AM et al (J Periodontol 79:2042-2047, 2008) which looked at the effect of duration and quantity of smoking, on the periodontal health of adolescents (15-16 years).

- Smokers of both genders had consistently higher periodontal indexes than non-smokers
- Boys had higher indexes for visible plaque, bleeding on probing and attachment loss
- Boys who smoked were significantly less likely to brush their teeth than non-smokers
- Tooth brushing habits were similar between smoking and non-smoking girls
- Girl smokers compared with non-smoker girls, presented with higher bleeding on probing values and visible plaque scores - irrespective of the amount they smoked

The positive in all these statistics is that adolescence is a great time for such health related messages to be presented and constantly re-enforced. The percentage of NSW secondary school students who had ever smoked has fallen from 57% in 1993, to 33% in 2005. We are often in the best possible position to counsel our patients and try to address this vital topic in an age group which may hopefully become more motivated to quit.

### Final Thoughts

Once again, I would like to thank the hard working ANZSPD team for their contributions during the current year. A great deal of correspondence is generated during the year, requiring

our Society's input and attention and the Divisional representatives and local committee members play an important and active role behind the scenes in addressing these matters.

I would also like to urge all members to support our local groups in ongoing events, particularly as mandatory CE is now formalised within all parts of Australia. Our Society plays a very active role in the provision of continuing education in ANZ and the topic of dentistry for children remains highly attractive to all members of the dental health care team.

I look forward to meeting up with many of you at the forthcoming Conferences and social events and wish you well as the next half of the year rolls on... keep safe 'til then.

*Kareen Mekertichian*  
Federal President ANZSPD



## New Zealand Branch President's Report

*Mary Anne Costello*

2011 seems to be a year focused on natural events; so far our thoughts initially were focused on our colleagues in Australia and all the flooding. Our sympathies fall to those who have been affected by the recent flooding.

Then the woes affecting Christchurch dramatically increased on February 22. All our ANZSPD members are safe but there are many interesting tales to tell. For myself, my Mother who lives in a Retirement Village in the northwest part of Christchurch continued with power and limited fuss thankfully, but many others were not so fortunate.

A past NZ branch ANZSPD President Joanna Pedlow, had her home seriously damaged in the September earthquake and has now abandoned it after the February quake. She is hosting, in her practice, an Orthodontist who lost both her home and practice with the February Quake.

The Hospital Dental Service, which sits on the edge of the CBD, on the Christchurch Hospital campus, where several of our ANZSPD colleagues work, has been affected. This building is repairable but will not be usable for several months at the least. Some hospital dental services are being provided from Community Dental Service clinics. Public GA services for children are due to resume soon.

However Cantabrians are very stoical and are wishing to move on. We wish them well in the long road ahead but we will be thinking of them often.

We note, with regret, the passing of Dr Jim McArthur after a short illness. He was a mentor to many dentists and dental therapists in the Hutt Valley and he made a quiet but significant contribution to our society over many years and he will be much missed.

Our Study day in late November hosted Professor Ritchie Poulton providing more insights from the Otago Multidisciplinary Study, coupled with many interesting presentations from local members.

We also thank Erin Mahoney for her considerable efforts as NZ president of ANZSPD. With Katie Ayers she provided significant input towards the organisation of the recent ANZSPD conference in Queenstown for which we are all very grateful. Erin also provides significant skill in organising our study day in Wellington, whilst managing a very young family, all very capably.

Dorothy provided a sterling job as Synopsis editor and we thank her for that. Yaso Ramodas is a new ANZSPD executive member.

We are also hoping for a rest from such disastrous natural events.

*Mary Anne Costello*  
President New Zealand Branch ANZSPD

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foods, many aimed at consumption by children, was noted, including in school canteens. The studies have highlighted the urgent need for professional dental care, preventive measures including moderation of intake of dietary sugars, and oral health education among these children.<sup>3</sup> In conjunction with the RAVDH Project in 2010, the study series addressed preschool-aged children and early childhood caries.

### Early childhood caries

Early childhood caries (ECC), also known as 'nursing bottle caries' or 'bottle caries', describes rampant decay of the primary maxillary incisors and molars of infants and preschool children.<sup>4,5</sup> In a workshop convened by the National Institutes of Health USA in 1999 the term ECC was proposed to describe the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces on any primary tooth (dmfs) in children up to 71 months of age.<sup>6</sup> Typically there is extensive plaque accumulation on maxillary primary incisors and less accumulation on mandibular primary incisors. Visible plaque accumulation on anterior primary teeth has been shown to correlate positively with caries risk.<sup>7</sup>

Past caries experience (dmfs/DMFS) in a child appears to be the best predictor of future caries.<sup>8</sup> In particular, caries on primary maxillary anterior teeth is associated with increased caries risk in other primary teeth.<sup>9</sup> Typically, carious lesions in ECC start on the low risk, smooth surfaces of maxillary incisors, reflecting the eruptive sequence of primary teeth and acquisition of cariogenic bacteria.<sup>10</sup> The interaction of factors such as newly-established bacterial flora, dietary substrates and oral hygiene practices may contribute to caries development in young children.<sup>4,11</sup> Dietary factors associated with ECC include frequency, timing and amount of sugar consumption. Frequent between-meal sugar consumption has been associated with development of ECC in preschool children.<sup>12</sup> Inappropriate bottle-feeding behaviours, particularly frequent night-time meal / drinks, increase the risk of caries development.<sup>13</sup>

### Oral health of rural schoolchildren studied in the RAVDH Project in 2010

In conjunction with the RAVDH Project conducted in March 2010 in Tan Hiep and Phu Giao, the present study investigated oral hygiene practices, dietary habits, drinking water, and caries experience of preschool-aged children. The author (VHN) is fluent in the Vietnamese language, facilitating the collection of observations. The study aim was to investigate the prevalence of caries and examine associations with the behavioural factors identified previously in older-aged school children, with the overall goal of enhancing preventive dental care for young children in rural Vietnam.

## Materials and Methods

### The Rotary Australia Vietnam Dental Health (RAVDH) Project 2010

As part of the RAVDH Project 2010, a volunteer group of dentists, dental specialists, dental nurses, a dental therapist and dental students attended the National Hospital of Odontostomatology in Ho Chi Minh City, the dental clinic in the Tan Hiep District Hospital, and the dental clinic in Phu Giao District Hospital. The two field teams each comprising three dentists, three dental nurses and one dental student, were accompanied by a Vietnamese interpreter, one dentist from the National Hospital of Odontostomatology, and personnel staff from both clinics.

Each team worked for one week in both Tan Hiep and Phu Giao. Children were pre-selected from nearby schools by local dentists for attendance at the RAVDH field team clinics. Prior to each clinical session, the children were triaged by treatment needs and relative difficulty. The treatment provided ranged from simple and complex restorations of permanent anterior and posterior teeth, fissure sealing of permanent posterior teeth, pulpal extirpations of permanent incisors, to extractions of symptomatic teeth. Instruments and consumables were brought from Australia. Glass-ionomer cement (Fuji IX™, GC Asia Dental Pty Ltd, Singapore) was used for sealants and

posterior restorations; some incisors were restored with resin composite.

The present study was undertaken in conjunction with the RAVDH Project 2010. One kindergarten in each village was chosen by the local dentist. The author (VHN) visited each kindergarten during the week the field team spent at the village.

### Study Sample

The study received ethics approval from the Departmental Human Ethics Advisory Group (Melbourne Dental School, University of Melbourne). Plain language statements, consent forms and questionnaires were given to teachers and principals of each kindergarten. A bilingual (English/Vietnamese) interpreter assisted VHN in explaining the project to teachers, principals and parents. The teachers and principal provided consent for children in Tan Hiep. In Phu Giao parental consent was given by completing the consent forms and questionnaires; the principal also provided consent. Child consent was indicated by their participation in the examination. A total of 208 children (Tan Hiep: 105; Phu Giao: 103) aged 2-5 years participated; the sample size was limited by the time spent at each village.

### Questionnaire

A 15 item questionnaire\* in Vietnamese containing choices and open-ended questions was used to collect data on the age, gender, oral hygiene habits, frequency and time of consuming sweet drinks and sweet foods, and drinking water sources of participants. Developed in English, the questionnaire was translated into Vietnamese then back-translated in order to verify translation accuracy. In Tan Hiep, the questionnaires were completed by the teachers, answering the questions according to their knowledge of each child, at times reading the questions to the children, and recording their answers; all 105 questionnaires (100%) were returned. In Phu Giao, the questionnaires were given parents; all 103 questionnaires (100%) were returned.

### Dental examination

The children were examined in classrooms; a dmft score was obtained



for each child from a mirror and sickle probe examination conducted by VHN. The examination was carried out using daylight and a headlight, with the child seated on a small chair with their head slightly tilted backwards; VHN sat on the ground in front of the child and viewed their teeth by direct vision and mirror. Restorations and missing teeth were charted; caries was diagnosed as visible cavitation or discolouration showed through enamel.<sup>14</sup> Some teeth were dried with gauze. The examination time was recorded (morning 8:15-10:30am; afternoon 3:00-3:45pm), and whether the child's teeth were brushed prior to examination. Teeth were not cleaned, dried or radiographed due to lack of facilities. A plaque index was recorded by scraping the maxillary primary central incisors with a sickle probe and recording plaque located on the gingival one-third, middle one-third or incisal one-thirds.<sup>15</sup> Scores were assigned for plaque limited to the gingival one-third (1), gingival and middle one-thirds (2), or gingival, middle and incisal one-thirds (3). The higher plaque score of the two assigned to the incisors was designated the child's plaque score. One dental anomaly was noted: fusion of a mandibular lateral incisor and cuspid. Teachers were informed of the caries status of each child and referrals were made to a dentist in the village.

### Statistical analysis

Data were entered into Excel spreadsheets (Microsoft Corp., Seattle, Washington, USA) and distributions were examined using descriptive statistics.

## Results

### Age and gender distribution

The study sample of 208, 2-5 year olds contained 105 children from Tan Hiep and 103 children from Phu Giao; 105 (50.5%) were female and 103 (49.5%) were male (Table 1). The study sample was distributed similarly for both villages for gender: females: Tan Hiep 25.0% vs. Phu Giao 25.5%; males: Tan Hiep 25.5% vs. Phu Giao 24.0%. Most children (87%) examined were aged 2-3 years.

### Completion of questionnaires

In Tan Hiep, the teachers reported the oral hygiene habits, sweet drinks and sweet foods consumption, and drinking water sources of the children; in Phu Giao parents reported on these questionnaire items. Consumption information was incomplete for: sweet drink intake (for 6 children), time of sweet drinks (20), intake of sweet foods (10), time of sweet foods (31), water intake (7), and drinking water source (13).

### Oral hygiene practices

All children were reported to have their teeth cleaned daily; for 10% of children this was once per day, for 37% twice per day, and 53% had their teeth cleaned three or more times per day (Table 2). More children in Phu Giao than in Tan Hiep had their teeth cleaned twice per day (50% vs. 24%), and more children in Tan Hiep than Phu Giao had their teeth cleaned three or more times per day (70% vs. 35%).

The distributions of children cleaning before breakfast and before bed were similar (Tan Hiep: 38%; Phu Giao: 45%). More children had their teeth cleaned before breakfast, after breakfast and before bed in Tan Hiep than Phu Giao (48% vs. 11%). Most children's teeth were cleaned before breakfast and before bed (41%), or before and after breakfast and before bed (30%).

In both kindergartens, the children were instructed (unsupervised) to brush their teeth after lunch using individual toothbrushes kept at school and a communal tube of fluoride-containing toothpaste (P/S™ Unilever Co. Ltd., Vietnam). Almost all children used a toothbrush and toothpaste (93%), including 35% who were reported to clean with a toothbrush and toothpaste only without other oral hygiene aids (Table 2). More children in Phu Giao than Tan Hiep used a toothbrush and toothpaste only (43% vs. 27%). Additional aids (mouthrinses, water, salty water) were used more frequently in Tan Hiep than Phu Giao (67% vs. 40%). The use of floss and toothpicks was rare: four children used toothpicks in addition to toothbrush and toothpaste, and 10 children used floss in addition to toothbrush and toothpaste (not tabulated).

### Consumption of sweet drinks, sweet foods and water

The distributions for consumption of sweet drinks, sweet foods and water were similar for females and males in each village, therefore data were collapsed (Table 3). A total of 20 children (10%) were reported to not consume sweet drinks. Most children were reported to consume sweet drinks once or twice per day (73%), and 30 children (14%) reportedly consumed these three or more times daily. The times of consuming sweet drinks were similar for both kindergartens: 63% consumed these between meals and 18% consumed these with meals. The intakes of sweet foods were similar for both kindergartens. Sixteen children (8%) were reported to not consume sweet foods. Most children (72%) were reported to consume sweet foods once or twice per day, and 33 children (16%) were reported to consume sweet foods three or more times per day; 62% were reported to consume these between meals and 15% consumed these with meals. All children drank water, typically from a tap (43%), purchased as bottled water from local markets (25%), or consumed from wells (21%). Tap water was boiled at home for 45 of the 89 children who drank tap water (not tabulated).

### Dental caries experience

The distribution of dmft scores by gender was similar for each village and combined scores are shown (Table 4). Only 7% of children were caries-free; 5% had a dmft of 1, most children (63%) had a dmft of 2-9, and 24% had dmft scores of 10-20. The mean ( $\pm$ SD) dmft score for all children was 6.6 (4.5); scores for females and males did not differ significantly: 6.5 (4.6) vs. 6.7 (4.3) (not tabulated). The mean dmft for Tan Hiep was less than for Phu Giao: 5.9 (4.4) vs. 7.3 (4.5). Sample homogeneity was apparent from the similar standard deviations for each gender and each village.

The distributions of caries patterns by gender were similar for each village and the combined values are shown (Table 5). Caries affected 93% of dentitions (mean dmft: 7.1). The maxillary incisors and/or cuspids were carious in 70% of

dentitions (mean dmft: 8.0), including 12% where these were the only carious teeth. In 82% of dentitions, caries affected the maxillary and/or mandibular molars (mean dmft: 7.7), including 23% where these were the only carious teeth. In total, 59% of dentitions had caries affecting both anterior and posterior teeth (mean dmft: 9.1).

The distributions of children by age and caries experience are shown (Table 6). There were 84 two year-olds, 98 three year-olds and 26 four to five year-olds (25 aged four and one aged five). The distribution of caries-free children decreased with age, down from 11% of two year-olds, to 4% of three year-olds, and 0.4% (1 child) of four to five year-olds. The caries prevalence increased slightly with age, up from 89% for two year-olds to 96% for four to five year-olds. Caries on maxillary incisors and/or cuspids (anterior caries pattern) was similar for all age groups (range: 68 - 73%). Caries limited to the maxillary incisors and/or cuspids decreased with increasing age, down from 20% of two year-olds to 6% of three year-olds and 4% of four to five year-olds. Caries on maxillary and/or mandibular molars (posterior caries pattern) increased in prevalence with age, up from 69% of two year-olds to 90-92% for three to five year-olds. Fewer dentitions showed caries limited to the maxillary and/or mandibular molars (17-28%). Caries affecting both anterior and posterior teeth increased with age, up from 52% of two year-olds, to 62% of three year-olds and 65% of four to five-year olds. The mean dmft of carious dentitions increased with age, up from 5.7 (4.4) for two year-olds to 7.3 (4.5) for three year-olds and 6.8 (4.0) for four to five year-olds.

#### **Plaque on maxillary central incisors**

The locations of plaque on the labial surfaces of maxillary central incisors and median plaque scores are shown (Table 7). The distributions were similar for children from both kindergartens. Only 8% of children were plaque-free on the labial surfaces of index teeth; 22% had plaque present on the gingival one-third, 45% had plaque on the gingival and middle one-thirds, and 11% had plaque on gingival,

middle and incisal one-thirds (total 78%). Carious labial surfaces of index teeth precluded plaque scoring for 14% of children. The overall median plaque score was two.

The location of plaque in relation to examination time (morning or afternoon) is shown (Table 7). Morning examinations (153 children) were conducted following variable toothbrushing at home. Afternoon examinations (55 children) were conducted after they had eaten, self-brushed their teeth (unsupervised) and taken a nap. Unsupervised, self-toothbrushing was ineffective in removing plaque from the index teeth in almost all children; plaque-free incisors were seen in only 9% of those examined in the morning, and in 4% of those examined in the afternoon. Toothbrushing time had no effect on plaque accumulation; similar plaque distributions were seen on index teeth regardless of variable brushing (morning, at home) or confirmed brushing (afternoon, at school). Similar distributions of dentitions had plaque covering the gingival one-third (morning brushing: 20%; afternoon brushing: 27%), gingival plus middle one-thirds (45%; 44%), and gingival plus middle plus incisal one-thirds (11%; 13%). The median plaque score for those examined in the morning was similar to those examined in the afternoon (2).

#### **Toothbrushing, intake of sweet drinks and sweet foods, and caries experience**

The reported distributions for toothbrushing and intakes of sweet drinks and foods for all children are shown (Table 8). Brushing frequency was unrelated to caries experience of dentitions with anterior caries only (range 9-14%), posterior caries only (range 21-29%), or anterior plus posterior caries (57-62%). Caries experience was unrelated to brushing time, although children for whom brushing reportedly occurred either before breakfast plus before bed, or both before and after breakfast plus before bed, were more likely to be caries-free (9%, 6%), and to have less anterior plus posterior caries (53%, 56%) than children with other brushing patterns.

The reported use of other oral hygiene aids in addition to brushing with toothpaste provided no further caries reduction; similar distributions were seen for dentitions which were caries-free (7% vs. 6%), had anterior caries only (11% vs. 13%), had posterior caries only (20% vs. 26%), or had anterior plus posterior caries (62% vs. 56%).

Concerning caries experience and sweet drink intake, caries-free dentitions decreased with increasing frequency of intake (down from 15% for no intake to 7% for three or more times per day), and dentitions with anterior caries only increased (up from 0 for no intake to 17% for three or more times per day; Table 8). Distributions for dentitions with anterior plus posterior caries showed some increase in caries experience with intake frequency (up from 60% for no intake to 67% for three or more time per day). A trend to higher caries experience was seen when the typical consumption of sweet drinks was between meals rather than with meals for dentitions with anterior caries only (12% vs. 11%), posterior caries only (23% vs. 19%), and for anterior plus posterior caries (61% vs. 57%).

Concerning caries experience and sweet food intake, dentitions with posterior caries only increased, up from 13% for no intake to 23-24% for one to two times per day, and to 27% for three or more times per day (Table 8). Distributions for dentitions with anterior plus posterior caries showed a decrease in caries experience with intake, down from 75% for no intake to 54-61% for one, two or three or more times per day. No consistent pattern was seen when the typical sweet food consumption was between rather than with meals.

## **Discussion**

The RAVDH Project brings dental awareness on their yearly visits to these villages in rural Vietnam, supporting the work of the dentists in each village. The present study continues previous studies of schoolchildren in rural Vietnam conducted in association with RAVDH Project visits in 2007-09 and reports on 208 children (aged 2-5 years) attending kindergartens in two villages. Dental examinations were conducted under

field work conditions and the method of data collection differed in each village: in Tan Hiep teachers completed the questionnaires for the children and in Phu Giao the questionnaires were completed by parents, so the authors were unable to verify the information collected.

The high caries experience reported in the previous studies<sup>1-3</sup> conducted in conjunction with the RAVDH Project was observed again in the present study. Of particular concern, the caries prevalence in the primary dentitions of the 2-5 year-olds was 93%, approaching the 94-96% observed in the permanent dentitions of the 11-16 year-olds examined in the three studies conducted in 2007-09 in conjunction with the RAVDH project visits in these rural villages. The mean dmft score for the preschool children in the present study was much higher than for the 11-16 year-olds ( $6.6 \pm 4.5$  vs.  $4.1 \pm 2.4$ ). In particular, in Tan Hiep the mean dmft for preschoolers was much higher than for older children in 2009 ( $5.9 \pm 4.4$  vs.  $4.1 \pm 2.6$ ). Further, it is likely that the caries experience of the preschool children was underestimated, since they were examined under field work conditions, whereas examinations of the 11-16 year-olds were conducted in established dental clinical facilities. These comparisons suggest an escalating problem in these villages with early initiation of childhood caries.

Both kindergartens visited were situated on the main street of the villages. Abundant supplies of inexpensive hard and sticky candies, sweet deserts, soft drinks, sweet flavoured milk and sweetened juices were available at numerous stalls adjacent to the school entrance and along the main street. Parents collecting their children could readily purchase sweet items from these stalls and also from a school-based stall that opened once school ended, specifically for parents to purchase sweets.

Sweet drinks commonly available in both villages were carbonated beverages (e.g. Coca Cola<sup>TM</sup>), sweetened ice tea, sweetened fruit-flavoured milk, sugar cane juice, and fruit juices. Popular sweet foods children were reported

to consume were candy, chocolate, sweetened porridge (made from rice, flour, mung beans and sugar) and ice cream; a wide range of fruits was also available. The teachers seemed uninformed about dental caries among their pupils and the need to moderate the intake of sweet drinks and foods as a preventive measure.

The unexpectedly high caries experience of children for whom none or low frequency of intake of sweet drinks and sweet foods was reported is of concern. Assuming the intakes were reported factually, clearly cariogenic factors other than those addressed were operating. Anecdotes and observations suggest that sweet milk is a popular drink for parents to give young children in these villages, and the current questionnaire did not address this intake; this will be addressed in future studies.

The kindergarten visited in Tan Hiep had approximately 200 children aged 6 months to 4 years. In each classroom an area was designated for students' own cups and toothbrushes; a communal tube of fluoridated toothpaste was provided. The kindergarten visited in Phu Giao was built in the past year with 30 classes of children aged up to five years. Each classroom had an adjoining bathroom with toilets, water faucets and basins and a designated area for each child's toothbrush; a communal tube fluoridated toothpaste was provided. Similar Vietnamese dishes (rice noodles in soup, rice with stir-fried vegetables and meats) were served to the children by the school cafeteria for lunch in both kindergartens. After lunch at 11am, the routine was similar for both kindergartens: the teachers told the children to brush their teeth with toothpaste at the communal sinks or basins; they then returned to their classrooms for a nap until 1pm. Toothbrushing was not supervised. The author noted the teachers encouraged the children to brush after their three meals each day and to rinse their mouths with copious amounts of water after brushing. Both kindergartens displayed toothbrushing posters showing step-wise pictures of a young boy cleaning his teeth: placing toothpaste on a toothbrush; scrubbing horizontally on the labial and occlusal

surfaces; using the toothbrush tip to clean the lingual surfaces of the maxillary anteriors; rinsing with water from a cup; and finally putting his toothbrush away. The author observed the children following these steps in both kindergartens.

Studies have shown a positive correlation between visible plaque on anterior primary teeth and caries risk.<sup>6</sup> Plaque was prevalent and extensive in distribution on the maxillary incisors of the children as shown by the 92% prevalence and the median plaque score of 2, indicating a high occurrence of plaque on the gingival and middle one-thirds of these index teeth. Clearly the unsupervised tooth brushing practiced in the kindergartens (and possibly at home) was ineffective in removing plaque and ineffective in preventing caries in the presence of the overwhelming cariogenic challenge from the children's diet.

School-based toothbrushing programs have been introduced in some schools for older children following previous RAVDH Project visits. The Project has fully funded a five-year toothbrushing program for children in a primary school in Tan Hiep, providing toothbrushes and fluoride toothpaste sufficient for all pupils twice weekly. The Project also currently supports a school-based dental hygienist with minor equipment, materials and education resources. The lower dmft seen in the present study of preschool children in Tan Hiep than in Phu Giao ( $5.9 \pm 4.4$  vs.  $7.3 \pm 4.5$ ) may reflect the influence of the school-based program on siblings of participating children in Tan Hiep. Similar school-based toothbrushing programs are urgently needed for kindergartens in these villages. Greater dental interest could be introduced by educating teachers about the relationship between caries and the children's sweet diets and oral hygiene practices. In particular, recently-developed teaching aids for this age group such as the 'Brighter Smile' kit prepared by Colgate Oral Care (Sydney, Australia) could be used by teachers in oral hygiene lessons.

Caries is a multifaceted disease associated with economic development, where the phenomenon of urbanization is associated



with an increased incidence of dental caries.<sup>16</sup> This socioeconomic factor is thought to be follow greater access to refined sugars, inadequate exposure to fluoride modalities, and other changes in lifestyle associated with migration to urban centres. As Vietnam becomes more westernised and industrialised, there is an increasing supply of refined sweet drinks and sweet foods, many aimed at consumption by children. The present study indicates that these trends are occurring in the rural villages studied, and the problem of dental caries is escalating to now include preschool-aged children who are very likely to continue to have a high caries experience in their permanent dentitions as adolescents.<sup>11,17</sup>

Recommendations made based upon the previous studies of older children in these villages are reiterated for preschool children. Effective oral hygiene practices and oral health promotion are needed urgently, with particular reference to increasing awareness of the relationship between dental caries and intake of sweet drinks and foods, teacher instruction and toothbrushing programs. Further study of the children's diets is needed in order to provide relevant home care advice.

## Conclusions

The caries experience of preschool-aged children in the villages of Tan Hiep and Phu Giao is very high and the problem appears to be escalating with the early initiation of childhood caries. Dietary sugars in the form of sweet drinks and sweet foods are readily available in both villages. This study highlights the urgency for professional dental care, preventive measures, and oral health education for teachers and parents of these Vietnamese children and their families.

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## For Further Information

For further information on the Rotary Australia Vietnam Dental Health Project, readers are encouraged to contact Dr James Robertson, at jamie@robdent.com.au.

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Table 1:

Distribution of 208 children aged 2-5 years (105 in Tan Hiep and 103 in Phu Giao) by age, gender and location

Age (years)	Distribution of children				Total children (N = 208) (%)
	Tan Hiep (N = 105)		Phu Giao (N = 103)		
	Female (n = 52)	Male (n = 53)	Female (n = 53)	Male (n = 50)	
2	31	35	10	8	84 (40)
3	19	16	29	34	98 (47)
4	2	2	14	7	25 (12)
5	0	0	0	1	1 (0)
Total (%)	52 (25.0)	53 (25.5)	53 (25.5)	50 (24.0)	208 (100)



**Table 2: Reported oral hygiene practices of 208 children aged 2-5 years in Tan Hiep and Phu Giao**

Oral hygiene practices	Frequency of pattern	Distribution of children		Total children (N = 208) n (%)
		Tan Hiep (N = 105) (%)	Phu Giao (N = 103) n (%)	
Tooth brushing (n=208)	None	0	0	0
	Once/day	6 (6)	15 (15)	21 (10)
	Twice/day	25 (24)	52 (50)	77 (37)
	Three or more/day	74 (70)	36 (35)	110 (53)
Time teeth brushed (n = 205)	Before bkfast + before bed	40 (38)	46 (45)	86 (41)
	Before + after bkfast + before bed	51 (49)	11 (11)	62 (30)
	Before +/-or after bkfast	7 (3)	19 (18)	26 (13)
	Before bed +/-or after bkfast	4 (4)	27 (26)	31 (15)
Oral hygiene aids used (n = 200)	Tbrush + tpaste + other	73 (69)	47 (46)	120 (58)
	Tbrush + tpaste only	28 (27)	44 (43)	72 (35)
	Tbrush or tpaste only	1 (1)	7 (7)	8 (4)
Other oral hygiene aids used <sup>(a)</sup> (n = 120)	Plus MR +/-or W +/-or SWR	70 (67)	41 (40)	111 (53)
	Plus Fl + MR + W + SWR +/-or TP	2 (2)	1 (1)	3 (1)
	Plus TP +/-or MR +/-or W +/-or SWR	1 (1)	5 (5)	6 (3)

(a) Aids used: MR: mouthrinse; W: water; SWR: salty water rinse; Fl: floss; TP: toothpicks.

**Table 3:**  
**Reported consumptions of sweet drinks, sweet foods, and water by 208 children aged 2-5 years in Tan Hiep and Phu Giao**

Consumption pattern	Frequency and time	Distribution of children		Total children (N = 208) n (%)
		Tan Hiep (N = 105) (%)	Phu Giao (N = 103) n (%)	
Intake of sweet drinks (n = 208)	None	10 (10)	10 (10)	20 (10)
	Once/day	53 (50)	42 (41)	95 (46)
	Twice/day	17 (16)	40 (39)	57 (27)
	Three or more/day	19 (18)	11 (11)	30 (14)
	No response	6 (6)	0	6 (3)
Time of sweet drinks (n = 188)	Between meals	66 (63)	65 (63)	131 (63)
	With meals	18 (17)	19 (18)	37 (18)
	No response	11 (10)	9 (9)	20 (10)
Intake of sweet foods (n = 208)	None	12 (11)	4 (4)	16 (8)
	Once/day	39 (37)	39 (38)	78 (38)
	Twice/day	31 (30)	40 (39)	71 (34)
	Three or more/day	15 (14)	18 (17)	33 (16)
	No response	8 (8)	2 (2)	10 (5)
Time of sweet foods (n = 192)	Between meals	58 (55)	71 (69)	129 (62)
	With meals	18 (17)	14 (14)	32 (15)
	No response	17 (16)	14 (14)	31 (15)
Drink water (n = 208)	Yes	103 (98)	98 (95)	201 (97)
	No response	2 (2)	5 (5)	7 (3)
Water source (n = 208)	Tap	51 (49)	38 (37)	89 (43)
	Bottled <sup>(a)</sup>	31 (30)	22 (21)	53 (25)
	Tap + bottled	7 (7)	0	7 (3)
	Well	10 (10)	33 (32)	43 (21)
	Well + tap/bottled	0	3 (3)	3 (1)
	No response	6 (6)	7 (7)	13 (6)

(a) Purchased from local markets.

**Table 4: Caries experience of 208 children aged 2-5 years in Tan Hiep and Phu Giao.**

Caries experience (dmft range)	Distribution of children		Total children (N = 208) n (%)
	Tan Hiep (N = 105) n (%)	Phu Giao (N = 103) n (%)	
0	10 (10)	4 (4)	14 (7)
1	9 (9)	2 (2)	11 (5)
2-5	33 (31)	31 (30)	64 (31)
6-9	32 (30)	35 (34)	67 (32)
10-16	20 (19)	29 (28)	49 (24)
17-20	1 (1)	2 (2)	3 (1)
Mean dmft ( $\pm$ SD)	5.9 (4.4)	7.3 (4.4)	6.6 (4.5)

**Table 5:****Distribution of 208 children aged 2-5 years in Tan Hiep and Phu Giao by caries experience of primary teeth**

Caries experience (primary teeth)	Distribution of children		Total children (N = 208) n (%)	Mean dmft ( $\pm$ SD)
	Tan Hiep (N = 105) (%)	Phu Giao (N = 103) n (%)		
Caries-free	10 (10)	4 (4)	14 (7)	0
$\geq 1$ carious surface/s	95 (90)	99 (96)	194 (93)	7.1 (4.2)
Caries on Mx incisors +/-/or cuspids	78 (74)	68 (66)	146 (70)	8.0 (4.2)
Caries on Mx incisors +/-/or cuspids only <sup>(a)</sup>	17 (16)	7 (7)	24 (12)	2.4 (1.1)
Caries on Mx +/-/or Md molars	78 (74)	92 (89)	170 (82)	7.7 (4.1)
Caries on Mx and/or Md molars only <sup>(b)</sup>	17 (16)	31 (30)	48 (23)	4.2 (2.6)
Caries on anterior + posterior teeth	61 (58)	61 (59)	122 (59)	9.1 (3.7)

(a)Posterior teeth caries-free

(b)Anterior teeth caries-free

**Table 6:****Distribution of 208 children aged 2-5 years in Tan Hiep and Phu Giao by age and caries experience of primary teeth**

Caries experience (primary teeth)	Distribution of children			Total children (N= 208) n (%)
	Two year-olds (N = 84) n (%)	Three year-olds (N = 98) n (%)	Four-five year-olds (N = 26) <sup>(a)</sup> n (%)	
Caries-free	9 (11)	4 (4)	1 (4)	14 (7)
$\geq 1$ carious surface/s	75 (89)	94 (96)	25 (96) <sup>(b)</sup>	194 (93)
Caries on Mx incisors +/-/or cuspids	61 (73)	67 (68)	18 (69) <sup>(b)</sup>	146 (70)
Caries on Mx incisors +/-/or cuspids only <sup>(c)</sup>	17 (20)	6 (6)	1 (4)	24 (12)
Caries on Mx +/-/or Md molars	58 (69)	88 (90)	24 (92) <sup>(b)</sup>	170 (82)
Caries on Mx +/-/or Md molars only <sup>(d)</sup>	14 (17)	27 (28)	7 (27)	48 (23)
Caries on anterior + posterior teeth	44 (52)	61 (62)	17 (65) <sup>(b)</sup>	122 (59)
Mean dmft ( $\pm$ SD) of carious dentitions	5.7 (4.4)	7.3 (4.5)	6.8 (4.0)	7.1 (4.2)

(a) Group contained 25 four year olds and one five year old

(b) Subgroup contained one five year old

(c) Posterior teeth caries-free

(d) Anterior teeth caries-free

**Table 7: Location of plaque on labial surfaces of maxillary primary central incisors for 208 children aged 2-5 years in Tan Hiep and Phu Giao**

Location of plaque on labial surface of maxillary primary central incisors	Distribution of children				
	Total children (N = 208) n (%)	Tan Hiep (N = 105) n (%)	Phu Giao (N = 103) n (%)	Morning exam <sup>(a)</sup> (N = 153) n (% of total)	Afternoon exam <sup>(b)</sup> (N = 55) n (% of total)
No plaque	16 (8)	10 (10)	6 (6)	14 (9)	2 (4)
On gingival one-third	46 (22)	24 (23)	22 (21)	31 (20)	15 (27)
On gingival + middle one-thirds	94 (45)	44 (42)	50 (49)	70 (46)	24 (44)
On gingival + middle + incisal one-thirds	23 (11)	14 (13)	9 (9)	16 (10)	7 (13)
Labial surface carious <sup>(c)</sup>	28 (13)	13 (12)	15 (15)	21 (14)	7 (13)
Mx central incisors missing <sup>(d)</sup>	1 (0.4)	0	1 (1)	1 (1)	0
Median plaque score	2	2	2	2	2

(a) Variable toothbrushing at home prior to clinical examination (morning)

(b) Toothbrushing conducted at school prior to clinical examination (afternoon)

(c) Caries of labial surface precluded plaque scoring

(d) Primary maxillary central incisors not present, precluding scoring

**Table 8: Distribution of 208 children aged 2-5 years in Tan Hiep and Phu Giao by toothbrushing, oral hygiene aids, intake of sweet drinks and sweet foods, and caries experience of primary teeth**

Distribution	Distribution of children				
	Total children (N = 208) n (valid %)	Caries-free (N = 14) n (% of total)	Anterior caries only <sup>(a)</sup> (N = 24) n (% of total)	Posterior caries only <sup>(b)</sup> (N = 48) n (% of total)	Anterior + posterior caries (N = 122) n (% of total)
<b>Toothbrushing (n = 208):</b> Once/day Twice/day Three or more /day	21 (10) 77 (37) 110 (53)	0 7 (9) 7 (6)	2 (10) 7 (9) 15 (14)	6 (29) 19 (25) 23 (21)	13 (62) 44 (57) 65 (59)
<b>Time teeth brushed (n = 205):</b> Before bkfst+ before bed Before + after bkfst+ before bed Before +/or after bkfst Before bed +/or after bkfst	86 (42) 62 (30) 26 (13) 31 (15)	8 (9) 4 (6) 1 (4) 1 (3)	7 (8) 13 (21) 1 (4) 1 (3)	25 (29) 11 (18) 6 (23) 6 (19)	46 (53) 34 (55) 18 (69) 23 (74)
<b>Oral hygiene aids (n = 191):</b> Tbrush + tpaste only Tbrush or tpaste only Tbrush + tpaste + MR +/or W +/or SWR	72 (35) 8 (2) 111 (59)	4 (6) 1 (13) 8 (7)	9 (13) 0 12 (11)	19 (26) 3 (38) 22 (20)	40 (56) 4 (50) 69 (68)
<b>Intake of sweet drinks (n = 202):</b> None Once/day Twice/day Three or more/day	20 (10) 95 (47) 57 (28) 30 (15)	3 (15) 7 (7) 2 (4) 2 (7)	0 12 (13) 6 (11) 5 (17)	5 (25) 17 (18) 22 (39) 3 (10)	12 (60) 59 (62) 27 (47) 20 (67)
<b>Time of sweet drinks (n = 168):</b> Between meals With meals	131 (70) 37 (20)	5 (4) 5 (14)	16 (12) 4 (11)	30 (23) 7 (19)	80 (61) 21 (57)
<b>Intake of sweet foods (n = 198):</b> None Once/day Twice/day Three or more /day	16 (9) 78 (45) 71 (41) 33 (19)	2 (13) 2 (3) 9 (13) 1 (3)	0 11 (14) 8 (11) 3 (9)	2 (13) 19 (24) 16 (23) 9 (27)	12 (75) 46 (59) 38 (54) 20 (61)
<b>Time of sweet foods (n = 161):</b> Between meals With meals	129 (80) 32 (20)	9 (7) 3 (9)	16 (12) 5 (16)	34 (26) 4 (13)	70 (54) 20 (63)

(a) Caries on maxillary incisors and/or cuspids only

(b) Caries on maxillary and/or mandibular molars only



# The use and potential benefits of Mineral Trioxide Aggregate in Paediatric Dentistry

Sue Taji. Lousie Brearley Messer Post-graduate essay competition Winner 2009

## Introduction

Mineral trioxide aggregate (MTA) is a relatively new material that has attracted widespread interest in dentistry over the past decade. This multi-purpose biomaterial has been investigated extensively for a wide range of endodontic applications in both the primary and permanent dentitions, for use in both general and Paediatric Dentistry. This recently introduced cement exhibits numerous beneficial properties not available in other contemporary materials currently used in provision of endodontics in Paediatric Dentistry. Extensive research is continuing worldwide to further elucidate the effectiveness and prognosis of MTA in its many applications. The aim of the present article is to review the properties of MTA materials, discuss its applications and look at the potential benefits for the Paediatric Dentistry field.

## Chemical, physical and mechanical properties of MTA

MTA was first introduced to the dental world in 1993 by Torabinejad.<sup>1</sup> MTA materials are a mixture of a refined Portland cement and bismuth oxide.<sup>2</sup> The major component, Portland cement, is a mixture of dicalcium silicate, tricalcium silicate, tricalcium aluminate, gypsum and tetracalcium aluminoferrite.<sup>2</sup> The more aesthetic white coloured MTA preparations lack the tetracalcium aluminoferrite.<sup>3</sup>

MTA differs from Portland cement as MTA products have smaller mean particle size, contain fewer toxic heavy metals, have a longer working time, together with additional processing and purification.<sup>4</sup>

In conjunction with being sterile, radiopaque and non-shrinking, the material is importantly not sensitive to moisture and blood contamination.<sup>5</sup>

## Setting characteristics of MTA

MTA is a powder that consists of fine hydrophilic particles that in the presence of water or moisture, forms a colloidal gel that solidifies to form hard cement within about 4 hours.<sup>6</sup> The product powder is mixed with supplied sterile water in a 1:3 powder/liquid ratio., leading to formation of an amorphous structure of calcium crystals consisting of 33% calcium, 49% phosphate, 2% carbon, 3% chloride, and 6% silica.<sup>7</sup> The setting process is described as a hydration reaction of tricalcium silicate and dicalcium silicate (with the dicalcium silicate being responsible for the development of material strength).<sup>8</sup> Hydrated MTA products have an initial pH of 10.2, which rises to 12.5 within the three hours of setting, after which it remains constant.<sup>7</sup>

Compressive strengths of MTA have been shown to increase for up to 21 days. Indeed the mean compressive strength of MTA at 21 days is 67.3 (+/- 6.6) MPa, which has been found to be comparable to IRM™ and super EBA™.<sup>7</sup>

## Bioactivity of MTA

MTA has an excellent track record for being biocompatible as well as bioinductive. This is supported by studies of cytotoxicity, subcutaneous and intraosseous implantation and direct contact with peri-radicular or pulpal tissues in vivo and in vitro showing that the cement is non-irritating to periapical tissues as well as being involved in regeneration of cementum and periodontal ligament.<sup>5,9</sup> MTA induces hard tissue formation through mechanisms that are still under investigation.<sup>10</sup> The cement has been found to stimulate immune cells to release lymphokines needed for the repair and regeneration of cementum, indicating that it can actively promote hard tissue formation.<sup>11</sup> Furthermore, numerous studies have shown a

possible link between MTA and induction of cytokine expression, leading to formative cell attachment and bone turnover.<sup>12,13</sup> MTA has also been shown to be cemento-conductive, leading to regeneration of cementum and periodontal ligament.<sup>14</sup> Furthermore, a direct correlation has been found between MTA and levels of osteocalcin, which leads to biomineralisation.<sup>14</sup> Thus, with respect to this material, the emphasis has shifted from mere preservation to regeneration of the remaining pulp tissue and further promotion of biological healing.<sup>15</sup>

MTA is also believed to promote formation of a dentine bridge through a mechanism similar to that of calcium hydroxide. Whilst MTA does not have calcium hydroxide as part of its composition, it has calcium oxide, which could react with tissue fluids to form calcium hydroxide.<sup>16</sup> The bioactive properties of MTA have led to MTA results being superior to calcium hydroxide with respect to dentine bridge formation. This can be best explained by the fact that MTA provides excellent protection against bacterial leakage, has a biocompatible quality that allows tissue repair and provides stimulations for hard tissue deposition.<sup>10</sup>

## Bacteriostatic and bactericidal properties of MTA

It has been suggested that MTA has both bacteriostatic and bactericidal properties.<sup>10</sup> Bacterial survival in an environment encompassing release of hydroxyl ions, a sustained high pH for extended periods, and the formation of a mineralised interstitial layer, will be highly challenged. The antibacterial effect is further promoted by the impervious seal produced by the MTA through its adaptation to adjacent dentine which includes penetration of MTA into the dentinal tubules.<sup>10</sup> Such anti-bacterial properties can be



a potent inhibitor of bacterial growth against species such as *Enterococcus faecalis* and *Candida albicans*, which are usually prevalent in root canal failures and refractory endodontic disease respectively.<sup>5</sup>

### Clinical applications of MTA

The diverse range of applications of MTA in the practice of paediatric dentistry include indirect and direct pulp capping and pulpotomy, apexification, apexogenesis and its use as root or furcation perforation repair and root end filling. The applications can be carried out in the primary dentition, immature permanent dentition as well as permanent dentition with fully developed root systems. The applications utilized in paediatric dentistry will now be further elaborated on.

### MTA as a pulp capping agent

Direct pulp capping is indicated for small mechanical or traumatic exposures when conditions for a favourable response are optimal. MTA can be applied over the exposure site to stimulate dentine formation and thus heal the wound and maintain pulpal vitality. This procedure is often reserved for permanent dentition. However in recent articles, Caicedo et al.<sup>17</sup> and Tuna et al.<sup>18</sup> demonstrated good pulpal response in primary teeth after direct pulp capping with MTA and concluded that MTA may be a favorable material for pulp capping even in primary teeth.

Partial pulpotomy in crown fractures of permanent teeth in children and young teenagers in which the dental pulps are exposed has traditionally been carried out using the Cvek technique, which relies on the use of calcium hydroxide as the active agent to promote hard tissue formation at the site and allow for continued root development.<sup>19</sup> As the action of MTA on exposed pulp tissue is similar to calcium hydroxide,<sup>20</sup> it may be used in partial pulpotomies in immature permanent teeth. The main advantages of MTA over calcium hydroxide is that MTA provides a good protective seal against microleakage, does not break down requiring replacements as is the case with calcium hydroxide, and the control of pulpal bleeding is not an issue as MTA sets in the presence of moisture.<sup>10</sup>

Indirect pulp capping is a procedure in which the caries closest to the pulp is left in place and covered with a biocompatible material, and the tooth is restored to prevent microleakage with the objectives of treatment remaining the same as for a pulpotomy.<sup>21</sup> Considering MTA's already mentioned characteristics, its use in indirect pulp capping for deep caries not extending to the pulp can be suggested in both the primary and permanent dentition. However long-term clinical research in this area is needed.

### MTA as a pulpotomy agent

Pulpotomy is still the most common treatment for cariously exposed pulps in asymptomatic primary molars with its main aims including preservation of radicular pulp, avoidance of pain and swelling, and retainment of the tooth in the dental arch until its exfoliation.<sup>22</sup> Due to recent health concerns regarding use of formacresol, in particular its carcinogenicity, mutagenicity and toxicity,<sup>23</sup> and with the profession's subsequent need to look for alternatives, MTA has come to the forefront as a pulpotomy agent.

In clinical reports and critical assessments of randomised and non-randomised human clinical trials, MTA has shown to have as good or better results when compared to formacresol which has always been viewed as the gold standard for provision of pulpotomy in primary teeth.<sup>15,24-28</sup> Indeed many experts in the field have concluded that MTA can be used as an alternative to formacresol.<sup>6,15,21,29</sup> MTA is certainly a very promising material in the field of endodontics and paediatric dentistry. However, despite both animal and human studies have shown MTA materials to have excellent potential as pulp-capping and pulpotomy medicaments, studies with long term follow up are limited.<sup>4</sup>

### MTA for apexification

The need for apexification may be encountered in immature permanent teeth with pulpal necrosis subsequent to trauma, dental caries or periapical pathosis secondary to presence of dens evaginatus.<sup>5</sup> In such cases, the clinician is faced with a difficult case of an

immature permanent tooth with thin dentinal walls and a wide, open apex in need of endodontic treatment. For many years the treatment of choice in such cases has been the apexification technique using calcium hydroxide.<sup>30</sup>

Observational studies of MTA apexification have demonstrated comparable or better healing outcomes to calcium hydroxide apexification.<sup>31,32</sup> Furthermore, MTA obturations in teeth with immature apices can induce apexogenesis by stimulating the mesenchymal stem cells from the apical papilla to promote complete root maturation in the presence of periapical pathosis or abscesses.<sup>33</sup>

In terms of fracture resistance, animal studies (in vitro and in vivo) have shown that teeth with an MTA apical barrier and MTA root filling to have higher fracture resistance in comparison with calcium hydroxide placed an intra-canal medicament.<sup>34-36</sup> Other reports indicate that long-term use of a calcium hydroxide dressing can weaken the root structure through neutralizing, denaturing or dissolving the acidic components of dentine, which is not evident when MTA is utilised.<sup>37</sup>

Moisture contamination at the apex of the tooth prior to barrier formation is often a problem with other materials typically used in apexification. Due to the hydrophilic nature of MTA, the presence of moisture such as blood does not impede its sealing ability.<sup>38</sup>

In addition to frequent cervical root fractures associated with use of calcium hydroxide, this traditional technique has the added disadvantage of increased treatment time, unpredictable results and delays in completing the final coronal restoration.<sup>10</sup>

In light of such results, the placement of MTA as a one-step apical barrier after appropriate debridement of the root canal is a suitable alternative to traditional multi-visit apexification.<sup>29</sup>

### MTA for treatment of root fractures in permanent teeth

Provision of an apical seal in the non-vital coronal portion of permanent teeth following root fracture has routinely

been performed by utilization of long term placement of calcium hydroxide prior to condensation of root filling materials. Taking into consideration the possible weakening effect of dentine through use of calcium hydroxide, and the length of time taken for provision of treatment, MTA has been suggested as an alternative material.<sup>10</sup> Despite lack of scientific research in this field, individual case reports with up to 2 year follow-ups have illustrated the use of MTA as an apical barrier for the coronal fragment of the root-fractured tooth to be positive.<sup>39</sup>

### Other indications for MTA canal obturation

Complete or partial obturation of the root canal system by using MTA is a viable option for teeth with extensive internal root resorption, open apices and select cases that show anatomic variations that include dens evaginatus, dens invaginatus, fusion or germination.<sup>5</sup> The bioinductive properties of MTA and its success in such complex cases should be considered when treatment alternatives can predispose the tooth involved to surgical therapy or extraction.<sup>5</sup>

MTA obturations have also been used to seal and retain primary teeth with pulpal involvement when no succedaneous permanent tooth is present.<sup>40</sup> It is however not recommended to obturate primary teeth that are expected to exfoliate as it is anticipated that MTA would be absorbed very slowly if at all.<sup>40</sup> MTA is also beneficial as a permanent obturation material in teeth that have undergone traumatic injuries such as luxation, intrusion, or avulsion.<sup>5</sup>

### Conclusion

MTA has emerged as a reliable bioactive material with extended applications in both primary and permanent dentition. The use of MTA in pulp therapy is supported with laboratory and clinical reports of its biocompatibility and promotion of healing with regeneration. Paediatric dentists have successfully incorporated MTA with its array of clinical applications since the late 1990s. Clinical impressions have

generally been favorable and support findings of laboratory and animal-based investigations as well as few clinical studies. Despite the overall positive results in human studies involving MTA materials, further longitudinal studies are encouraged due to current lack of sufficient well-designed and controlled clinical studies, longitudinally, on sufficiently large number of subjects. Based on current evidence, MTA has the potential to become a routinely used material in the field of paediatric dentistry.

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## **R.K. Hall Visiting Lecturer: Prof. Joel B**

We are proud to announce that in 2011, the R.K. Hall Visiting Lecturer will NOT be moving from State to State and New Zealand, but rather will be able to deliver a more comprehensive series of lectures at the R.K. Hall site in the Centre of Australia, in Uluru.

Remember that there is a 'tyranny of distance' necessitating arrival in Uluru on Wednesday 24th August 2011 and departure mid-morning of Sunday 28th August 2011. You will be part of the captive audience.

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# SPD

## Sunday 28 August 2011 Sails in the Desert, Northern Territory, Australia

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## President Elect IAPD Report

*Eduardo Alcaino*

**Athens is fast approaching and preparations are well and truly on the way. The Greek local organising committee, headed by the very energetic Prof. Lisa Papagiannoulis have worked tirelessly towards a unique experience, a stimulating scientific programme and an exciting social and accompanying person's program.**

Dear Colleagues,

I am happy to inform that ANZSPD, through its executive committee and Federal President, Dr K Mekertichian have agreed to support the pre-congress course on "Basic Paediatric Clinical Procedures". This course is coordinated by the efforts of A/Prof Richard Widmer and Dr Sotiria Gizani (Greece). Several Australian members will also contribute in this 'hands on' seminar and ANZSPD has been given a level of Gold Sponsor for this pioneering support at an international congress. The Course is primarily aimed at those clinicians who want to upgrade their basic skills learned in Dental School and apply them in their clinical practice. More information may be found at <http://www.iapd2011.org/program/index.htm>

In addition, the Australasian Academy of Paediatric Dentistry with the same idea of supporting a major congress of IAPD, has agreed to sponsor two plenary sessions during the main scientific programme. I am proud that our organizations in Australasia are so involved with IAPD and I am very thankful for the support that I have received from many of my colleagues.

It is hoped that in future, other national societies will become involved in sponsorship of international meetings as the ANZSPD and AAPD have done. Both groups have shown their leadership and willingness to be an active part of the Athens Congress.

IAPD always welcomes the participation and interests of new members either as delegates or in more active roles such as IAPD committees. Willingness to serve, donate your time and experience as professionals are the core of societies such as IAPD. Through more members, sponsorship and support from trade companies and national societies, IAPD will continue to grow (with now 53 member countries) and provide education and resources to more disadvantaged areas in the world.

Future congresses of IAPD will take place in Seoul, South Korea (2013), Glasgow, Scotland (2015) and Santiago, Chile (2017). I encourage all of you (if not already) to become members of IAPD and share the comrade and friendship with your fellow international colleagues.

I hope to see many of you at the upcoming congress in Athens and to also join us at all the social events including the "beach party", which is to be held on the Saturday night after the congress.



## Message from the Editor

*Timothy Johnston*

**"Welcome to the first edition of Synopses for this year."**

2011 is here and flying by and a tumultuous year it has been so far. Fortunately all our Colleagues in New Zealand are safe and we all hope life is returning to normal again.

Welcome to the first edition of Synopses for this year. Unfortunately we have no articles for Brief Case this issue, a reminder that it is a forum to submit interesting cases that have a wide interest to readers. Papers do not need to be of peer review level, so please send things in.

A little bit of information supplied by Dr Verco with relation to the RK Hall Meeting at Uluru in August this year. "Dr Hall received his OAM at Government House, Melbourne in 1996. It was the year that John Farnham got his AC, so Roger was in good Company. Afterwards we celebrated with luncheon in the Melbourne Club with South Australian Whiting and a bottle of Grange Hermitage. (Read for ...fish and chips and a bottle of red!).

The file for the next edition is empty, please submit any articles or information you would like to publish.

## IAPD ADVERT

# “Discuss post-trauma sequelae in the primary dentition and its subsequent management”

Rohan Jagota. Louise Brearley Messer Under-graduate Essay Competition Winner 2010

## Introduction

Dental injuries to the primary dentition are common, affecting 30-40% of children, with 40% of children reportedly having their first dental visit following a traumatic incident.<sup>1,3</sup> In light of this, it is essential that all dental practitioners have a firm knowledge of how to manage dental trauma affecting primary teeth, as well as the sequelae. These injuries have a peak incidence between the ages of 1 and 3 years, at which time most babies are beginning to walk unassisted.<sup>3,5</sup> It is, therefore, no surprise that falls are the most common cause of trauma to the primary dentition.<sup>2,5,6</sup> This makes prevention particularly difficult, which underscores the importance of knowing how to treat these injuries.

When discussing dental trauma, it is useful to group injuries into a number of classes:

- injuries to the hard dental tissues and pulp;
- injuries to the periodontal tissues;
- injuries to the supporting bone, and;
- injuries to the gingiva or oral mucosa.<sup>3</sup>

While the most common injuries in the permanent dentition involve the dental hard tissues, most traumas to the primary dentition causes luxation type injuries.<sup>1,3,7</sup> This predilection toward injuries to the periodontium is attributed to the reduced density of bone in the jaws of young children, which is primarily due to the developing successors taking up so much space within the jaws.<sup>1,3</sup> Furthermore, the bone is less mineralised, meaning that force applied to a tooth is more likely to displace it within the alveolar bone than to fracture the tooth itself.<sup>1,3</sup> It is important to recognise that there may also be delayed complications of trauma to the primary dentition which may be

within the primary dentition itself, or in the permanent successors.<sup>3,4,8-13</sup>

While treatment of injuries to the primary dentition bares some similarities to treating those of the permanent dentition, there are a number of significant differences. Since many children who suffer trauma to their primary teeth will have never been to the dentist before, it is important to ensure that treatment is as atraumatic as possible to avoid instilling a lifetime of dental anxiety in the young child.<sup>1,3,14</sup> Moreover, children, particularly those below the age of three, are unlikely to co-operate with the dentist, and this may make lengthy treatment impossible without resorting to conscious sedation.<sup>1,3</sup> While this is a viable treatment option, the short period of time that these teeth are to remain functional may sometimes make this method of treatment unjustifiable in both its risks and financial costs. This is particularly true with regards to the maxillary central incisors, the most commonly injured teeth, which will only serve the child until 7 years of age.<sup>3</sup> Perhaps the most distinctive point, though, is the risk of injuring the permanent successor through treatment, or lack thereof. The close proximity of the primary tooth to the developing tooth germ means that the permanent tooth is quite prone to damage as a result of luxation injuries.<sup>1,3,8,11</sup> More to the point, though, the permanent tooth may be damaged as a result of treatment of the primary tooth, or as a result of infection in the primary tooth.<sup>1,3,8,11</sup> In order to prevent iatrogenic damage to the permanent successor, conservative treatment is usually indicated.<sup>1,3,14</sup> To prevent damage as a result of infection, it is vital that a thorough clinical and radiographic assessment is made and that an appropriate follow-up schedule is organised.<sup>1,14</sup>

## Examination

Any discussion on the management of dental injuries must also detail the recommended examination protocol. This must include relevant medical and dental history, extra-oral examination, intra-oral examination, and radiographic assessment.<sup>1,3</sup> It is important to keep mindful of the fact that the child and parent are likely to be very shaken as a result of the traumatic incident, and the dentist should be appropriately empathic.

## History

The medical history should include any conditions the child has, or medications the child is taking, that may influence his or her treatment.<sup>1</sup> Tetanus immune status should be evaluated and, if the child has not been immunised, they should be referred to a physician if infection is likely.<sup>1</sup> As severe head injury is a possibility, any indication of neurological disturbance requires immediate referral.<sup>1</sup>

The dental history should provide full details of when and how the injury occurred.<sup>1,3</sup> Otherwise it will be impossible to correctly determine the severity of trauma and the degree of healing that is likely to have already occurred.<sup>1,3</sup> This information is vital when deciding proper management.

## Extra-oral Examination

The extra-oral examination will give clues as to the extent of injury suffered to the teeth and jaws as well as to other parts of the head and neck.<sup>1</sup> The jaws and zygomatic arches should be palpated to determine whether any fracture has occurred, and this may also be indicated by subcutaneous haemorrhage.<sup>3</sup> The patient's jaw mobility should also be assessed to detect any damage to the temporomandibular joint. Any abrasions and lacerations should be noted, as well as any bruising.<sup>3</sup> The dentist should especially take note of



any bruising in unusual areas, such as the neck or cheeks, or any hand-shaped bruises, all of which may be indicative of child abuse.<sup>1</sup> Stiffness of the neck should be considered as possible evidence of cervical spinal cord injury.<sup>1</sup>

### Intra-oral Examination

When conducting the intra-oral examination, the dentist should first give attention to the lips and oral mucosa.<sup>1,3</sup> Within the mouth, abrasions and contusions are not as common, although lacerations may be seen, including tears of the frenal attachments.<sup>1,3</sup> Again, submucosal haemorrhage may be a sign of jaw fracture.<sup>3</sup> The teeth should be assessed for any tenderness to percussion or bleeding from the gingival sulcus which are signs of injury to the periodontium.<sup>1,3</sup> Any increase in mobility should be identified as a sign of subluxation, root fracture, extrusive luxation or infection.<sup>1</sup> If a group of teeth move together, this indicates fracture of the alveolar bone.<sup>1,3</sup> Any alterations in tooth alignment should be noted; particularly those that cause occlusal interferences.<sup>1,3</sup> It is also useful to palpate the labial and palatal of the alveolus, as it may be possible to feel a displaced root.<sup>3</sup> A fistula may be seen as a sign of a chronic abscess if the injury is not recent.<sup>3</sup> Pulp sensibility testing has limited use in children because they will often react to any stimulus and, hence, it is not usually carried out.<sup>1,3,10</sup>

### Radiographic examination

A thorough radiographic examination is important in all but the most straightforward cases of trauma. The occlusal view radiograph is typically used since it is usually not possible to accurately place the film for a periapical radiograph, even with the parent's assistance.<sup>3</sup> As in the permanent dentition, radiographs are useful for determining the distance between crown fractures and the pulp, for locating root fractures, and for identifying alveolar fractures.<sup>1</sup> In the primary dentition, though, they can also show the relationship of the displaced primary tooth to the developing successor.<sup>1,3</sup> Using an occlusal view, it is possible to infer whether the root

has been labially or palatally displaced based on whether the tooth appears foreshortened (labially displaced) or elongated (palatally displaced) and, hence, the risk of damage to the successor may be deduced.<sup>3</sup> Some authors advocate the use of a lateral projection radiograph as an adjunct to the occlusal view.<sup>1,3</sup>

### Management of post-trauma sequelae

As mentioned previously, the sequelae of trauma to the primary dentition include those affecting the primary dentition itself, and those that affect the permanent dentition. In the primary dentition, sequelae may be further divided into immediate complications and delayed complications, while those occurring in the permanent dentition are all considered to be delayed complications. Because of the possibility of delayed complications, it is imperative that all patients are reviewed regularly, at least until the successor has erupted.<sup>14</sup> A recommended follow-up schedule has been produced by the International Association of Dental Traumatology (IADT) and is included as Appendix 1.

### Management of sequelae occurring in the primary dentition: Immediate Complications

#### Uncomplicated crown fractures

Crown fractures that do not involve the pulp will usually only require the removal of sharp edges using an abrasive disc or bur.<sup>1,3,6,14</sup> If the parents desire a more aesthetic solution, a composite restoration may be placed, although the more conservative treatment is preferable.<sup>1,3</sup>

#### Complicated crown fractures

Current guidelines for complicated crown fractures, as published by the IADT, recommend a pulpotomy using calcium hydroxide in all cases, regardless of the tooth's stage of development.<sup>14</sup> Due to the child's traumatic state, it may often be difficult to achieve full co-operation.<sup>1,3</sup> Because a pulpotomy is a technique sensitive procedure, in these cases it may be

necessary to either put the child under conscious sedation or extract the tooth.<sup>1,3,14</sup> However, extractions may cause damage to the gubernacular cord or loss of facial bone, and should only be carried out as a last resort.<sup>3</sup> It should also be remembered that extractions do not obviate the need for a cooperative child.<sup>3</sup>

#### Crown-root fractures

Crown-root fractures can usually be detected by the increased mobility of the fractured portion, as well as by their radiographic appearance.<sup>1,3,14</sup> Typically, the fractured proportion will be held in place by the periodontal and gingival fibres.<sup>1,3</sup> Whether the fracture does or doesn't involve the pulp, the preferred treatment is extraction.<sup>1,3,14</sup> To prevent damage to the developing tooth, small root fragments may be left in situ if they cannot be removed easily.<sup>1</sup> These fragments will resorb spontaneously.<sup>1</sup>

#### Root fractures

Root fractures are detected by increased mobility and crown displacement, and radiographic evidence of a fracture, usually located mid-root or in the apical third.<sup>1,3,14</sup> If displacement and mobility of the crown fragment is minimal, treatment is not required and the tooth will resorb normally.<sup>1,3,14</sup> If there is excessive mobility, the coronal fragment should be extracted to avoid aspiration, and the root fragment may be left in place to resorb spontaneously.<sup>1,3,14</sup>

#### Concussion and subluxation

Concussion and subluxation are both minor injuries to the periodontal ligament, both resulting in tenderness to percussion.<sup>1,3</sup> They differ in that a concussed tooth has no increase in mobility, while there is a minor increase in mobility in the subluxed tooth.<sup>1,3</sup> Subluxation may also lead to bleeding from the gingival sulcus.<sup>1,3</sup> Radiographically, their appearance is normal.<sup>1,3,14</sup> Treatment is not usually required, apart from instructing the parents to maintain good oral hygiene for the child which should include the application of chlorhexidine to the tooth, twice a day for a week.<sup>3</sup> In some children, it may be necessary to slightly relieve the occlusion.<sup>1</sup>

### Lateral luxation

Lateral luxation typically occurs following impact from a labial direction, which displaces the crown palatally<sup>1, 3</sup>. In the case of mild palatal displacement of the crown, the tooth may be allowed to reposition itself, as long as there is no occlusal interference<sup>1, 3</sup>. This is generally complete within three months, and is brought about by lip and tongue pressure<sup>1</sup>. In cases of more severe displacement, there is disagreement in the literature as to how to proceed with treatment. While some sources suggest repositioning the tooth and splinting for 2-3 weeks, or, otherwise, grinding the tooth to remove the occlusal interference, other sources suggest extracting all severely displaced teeth<sup>1, 3, 14</sup>.

### Intrusion

Intrusive injuries have the most potential to cause damage to the developing teeth<sup>1, 3, 10, 11, 13</sup>. The direction of intrusion, toward the labial or the palatal, will affect the risk of permanent tooth damage and therefore dictate what treatment is necessary<sup>1, 3, 10</sup>. Thus, it is essential to assess the relationship of the primary tooth to the successor using an occlusal or periapical radiograph in combination with a lateral projection<sup>1, 3</sup>. Because of the curvature of the primary maxillary incisor root, the apex is typically driven toward the labial<sup>1</sup>. In mild cases, the tooth may be allowed to reposition spontaneously, which takes 1-6 months on average<sup>1, 3, 10</sup>. In more severe cases, though, where there has been fracture of the labial cortical plate, it is recommended to extract the intruded tooth and reposition the bone, with or without splinting of the adjacent teeth<sup>1</sup>. When the primary tooth is intruded palatally such that it enters the dental follicle, the tooth must be carefully extracted using forceps, so as to minimise damage to the successor<sup>1, 3, 10</sup>.

### Extrusion

Treatment of extruded teeth depends on how long ago the injury occurred<sup>1, 3</sup>. If the patient is seen soon after the injury, it is usually possible to reposition the tooth and splint it, or the tooth may be allowed to spontaneously

reposition<sup>1, 3, 14</sup>. If a blood clot has been allowed to form, the tooth must either be allowed to reposition, or it should be extracted<sup>1, 3, 14</sup>.

### Avulsion

In all cases of suspected avulsion where the missing tooth has not been found, it is imperative to take a radiograph to rule out complete intrusive luxation of the tooth<sup>1, 3</sup>. If the tooth still cannot be found, it is recommended that a chest radiograph be taken to assess whether the tooth has been inhaled<sup>3</sup>. Replanting avulsed teeth is not recommended by the current literature due to the risk of damaging the successor<sup>1, 3, 14</sup>. There is also a risk of damage to the successor following pulp necrosis in implanted teeth<sup>1, 3</sup>. A removable or fixed appliance can be placed if the parents so desire, but care should be taken not to interfere with the physiological expansion of the jaw<sup>1</sup>.

### Injuries to the oral mucosa

All injuries to the oral mucosa should be cleaned and debrided as necessary to avoid a foreign body reaction or infection<sup>3</sup>. Soft tissues should be repositioned and sutured in place as soon as possible, to prevent a permanent deformation due to the tissues healing in place<sup>3</sup>.

## Delayed complications

### Discolouration

Discolouration is a common sequela of primary tooth trauma<sup>1, 3, 9, 15</sup>. The tooth generally changes colour to grey as a result of blood pigments collecting within the pulp chamber, and this discolouration may be transient or permanent<sup>1, 3, 9, 15</sup>. In transient discolouration, the tooth usually turns from grey to yellow, and this has been regarded as an indication of pulp vitality<sup>3, 9, 15</sup>. Indeed, only 3.4% of teeth with this condition were found to undergo pulp necrosis in a recent study<sup>9</sup>. This should be compared to data from the same study that found that 65.7% of teeth with permanent discolouration underwent pulp necrosis<sup>9</sup>. A recent study, by Holan, investigated the incidence of damage to the permanent tooth following

endodontic treatment that was carried out as soon as discolouration was diagnosed, compared to when endodontic treatment was delayed until a diagnosis of pulp necrosis was made; he found no significant difference between the two<sup>15</sup>. Hence, in the interest of minimising treatment, root canal therapy should only be carried out following a diagnosis of pulp necrosis<sup>3, 9, 15</sup>.

### Pulp necrosis

Pulp necrosis is difficult to diagnose in the primary dentition due to the limited ability to conduct vitality tests<sup>1, 3</sup>. However, necrosis following trauma does not, in itself, necessitate treatment unless there are signs of infection. In primary teeth, it is often difficult to detect a periapical radiolucency due to the presence of the secondary dentition<sup>1, 3</sup>. Other signs of infection may be seen, though, such as acute inflammation with swelling and/or abscess formation, a developing fistula, or internal inflammatory root resorption<sup>1, 3</sup>. It is possible to carry out root canal treatment in infected primary teeth, although the success rate is not high, and treatment may cause damage to the developing tooth<sup>3</sup>. Replacement resorption is a sequela of necrosis, but it is not a sign of infection and can be left untreated, experiencing only slightly delayed exfoliation<sup>1, 3</sup>.

### Pulp canal obliteration (PCO)

PCO occurs following more than a third of traumatic dental injuries<sup>9</sup>. These teeth require no endodontic treatment unless there is evidence of pulp necrosis and infection<sup>3</sup>. Following repeated trauma, teeth with PCO are more likely to experience necrosis due to their decreased healing potential<sup>3</sup>.

### Alterations to physiological root resorption

Delayed or accelerated physiological resorption may sometimes occur following trauma<sup>3, 9</sup>. It is believed that this only occurs in teeth with pulp necrosis, although the evidence is not strong<sup>3, 9</sup>.

## Management of sequelae occurring in the permanent dentition

Disturbances in the permanent dentition following injury to the primary dentition are most commonly caused by subluxations<sup>16</sup>. However, severe disturbances tend to be caused by intrusive luxation, and may also be caused by lateral luxation with a labially displaced crown or a severely palatally displaced crown<sup>1, 3, 11, 16</sup>. These may cause abnormalities of the crown, the root or the whole tooth<sup>4, 11</sup>. The location seems to be affected primarily by the age at which the trauma occurred, and by the severity of the injury<sup>11</sup>. Other causes of disturbances include some treatments, such as extraction and root canal treatment, and infection of the predecessor<sup>3, 11</sup>. Parents should be warned of the possibility of permanent tooth disturbances following all incidences of trauma to the primary dentition<sup>1, 3, 11</sup>. Severe disturbances often require a multidisciplinary approach to treatment<sup>4, 12</sup>.

### Crown abnormalities

Crown abnormalities tend to occur following trauma before the age of 3, by which time crown formation in permanent incisors is usually complete<sup>11</sup>. However, white or brown discolouration may be caused by injuries up to the age of 7<sup>11, 16</sup>. White discolouration is caused by a reduction in mineralisation during the maturation phase of development, while brown discolouration is brought about by the breakdown products of haemoglobin subsequent to bleeding<sup>11</sup>. Following a moderate intrusive luxation, hypoplastic, pitted defects may also be seen<sup>3, 11</sup>. Treatment may include a number of restorative options<sup>11</sup>. If discolouration is minimal, abrasion may be sufficient for removal, whereas deeper discolouration or hypoplasia may require composite restoration or, at a later age, porcelain veneers.

Crown dilacerations occur following intrusion before the age of 2 years and they are caused by the root apex invading the partially formed follicle<sup>11</sup>. It is usually possible to diagnose this condition radiographically before eruption of the tooth<sup>11</sup>. It is recommended that the dilacerated portion of the crown be removed soon

after eruption, and a provisional crown placed, so as to avoid pulp necrosis which is a common complication<sup>11</sup>. If eruption is delayed, surgical exposure and orthodontic extrusion may be necessary<sup>11, 12</sup>.

### Root abnormalities

Intrusive injuries occurring between 2-5 years of age may lead to disturbances in root formation<sup>11</sup>. The force results in deflection or displacement of Hertwig's epithelial root sheath<sup>11</sup>. This can either cause root duplication, root dilacerations or cessation of root formation<sup>11, 16</sup>. The former two abnormalities may lead to delayed eruption which could require orthodontic extrusion, and it is possible that a crown will eventually need to be fabricated<sup>11</sup>. Teeth with incompletely formed roots are likely to exfoliate due to insufficient periodontal support, and prosthetic replacement is likely to be required<sup>11</sup>.

### Abnormalities affecting the whole tooth

Cessation of tooth formation may occur following a severe intrusive luxation, or chronic periradicular infection<sup>11</sup>. It is diagnosed radiographically, based on the appearance of a large radiolucency surrounding the permanent tooth germ, with no visible outline of the dental crypt<sup>11</sup>. This requires antibiotic treatment in conjunction with enucleation of the germ and surrounding granuloma<sup>11</sup>.

Severe intrusion can also cause an odontoma-like malformation of the permanent tooth<sup>4, 11</sup>. This will occur following invasion of the permanent tooth germ during the early stages of odontogenesis, between the ages of 1 and 3 years<sup>11</sup>. These teeth do not erupt, and require surgical removal<sup>4, 11</sup>.

Eruption of the permanent tooth may be affected by the early loss of the primary predecessor<sup>11</sup>. If the primary tooth is lost before 4 years of age, eruption may be slowed down, which could be due to the development of a thick, fibrous gingiva<sup>11</sup>. If the primary tooth is lost after the age of 5, though, eruption is accelerated due to reduced impedance<sup>11</sup>. Ectopic or displaced

eruption may occur due to retention of the primary tooth, displacement of the permanent tooth germ, or deficient eruption guidance following early loss of the primary tooth<sup>11</sup>.

### Conclusion

Trauma in the primary dentition may produce an array of consequences affecting both the primary dentition and the permanent dentition. While the sequelae appearing in the primary dentition are similar to those following trauma to the permanent dentition, their management differs greatly. This is because treatment in the young child must aim to minimise dental anxiety, as well as minimising trauma to the developing permanent teeth. Conservative treatment is, therefore, carried out whenever possible. The vast number of potential delayed consequences demands the implementation of regular follow-ups, usually until the eruption of the successor. Only with the correct management protocol, is it possible to achieve the required result.

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## Federal Secretary-Manager's Report

*Alistair Devlin*

I have received a few questions in recent times regarding membership categories in ANZSPSD Inc., and also what the membership entitlements are. It is a complex picture, with each of the Branches having a Constitution of their own, and within that, they will have their own unique definitions for their membership categories. I will only be considering the Federal categories here. The first is that of Full membership. This is any dentist registered in Australia or New Zealand and who belongs to either the Australian Dental Association Inc. or the New Zealand Dental Association Inc. The Federal Constitution then goes on to say that this person must show proof of interest in the objects of the Society and must be of good repute and professional standing. I have no recollection of the process of measuring up to these requirements ever having been applied! I suppose if a member does get up to some mischief, the Society does have an avenue to disown them through these requirements.

The Federal Society has a category of Associate Member. This is open to any dentist or dental auxiliary registered in Australia or New Zealand who is not an ADA or NZDA member. They, too, have to show proof of interest in the objects of the Society and also to be of good repute and professional standard. They are excluded from voting rights at general meetings and aren't permitted to hold office in the Society.

The third category is that of Honorary Member and there are two sub-categories in this one. The first of these is to cover people who aren't eligible for full membership [e.g. who aren't dentists] but who wish to contribute to the Society and whose special knowledge would benefit the

Society. The second sub-category is for people who are eligible for full membership, but who have either retired from active practice or who have reached the age of 65 years.

All members then have to be "elected". This is done in one of two ways. Firstly, if a person is a member of a provincial branch, they will automatically become a federal member provided that branch endorses their nomination and the required individual member federal subscription is paid. There is another way to become a federal member and that is by nomination by an existing member of ANZSPD at a general or special meeting of the Society, and then for that nomination to be acceptable to two thirds of those present at the general or special meeting. Their membership is then official once they pay their subscription. This is another clause which is very rarely, if at all, used. However, it could be applicable in the case of someone not living in Australia or New Zealand.

Having said all that, there is a final non-official category of membership, and that is the so-called "mailing list only" member. There are many of these on our mailing list, people living overseas or University Libraries for example. They will receive editions of this august journal, Synopses!

So what are the entitlements of membership? Receiving Synopses for a start, plus access to events conducted by the branches and the Federal body. One thing it doesn't give is individual membership of our parent body, the International Association of Paediatric Dentistry. To become a member of IAPD, the individual needs to contact IAPD directly. For a few years in the previous decade,

ANZSPD did act as an agent for our members wishing to join IAPD. Unfortunately this scheme has been allowed to lapse. The main reason was that the Australian and New Zealand membership years didn't coincide with the IAPD year. It became an increasingly messy arrangement and therefore, was discontinued. If an individual wishes to obtain IAPD individual membership, merely visit their website at [www.iapdworld.org](http://www.iapdworld.org)

*Alistair Devlin*

### Recognition of Alistair Devlin for his Service to Paediatric Dentistry.

**Speech by Dr Carmel Lloyd, President ANZSPD (WA Branch) at the University of Western Australia's Undergraduate Awards Presentation Evening.**

"It is always a pleasure to recognise the achievements of our colleagues and tonight I have the privilege to acknowledge those of one of our most recent graduates and the lifelong achievements of Associate Professor Alistair Devlin, after whom this undergraduate prize in dentistry is now named.

The Award has been renamed in recognition of Alistair's dedicated contribution to dentistry, including an outstanding service to the West Australian and Federal branches of the Australia and New Zealand Society of Paediatric Dentistry as Secretary-Treasurer/ manager for over 30 years; as well as holding positions on many other professional committees, including President of the Alumni Society. He has also engaged in the training of dental students in various capacities throughout his career. In addition to this tireless, dedicated service to the Paediatric Society, Alistair has unfailingly demonstrated ethical practice, professional competence and genuine concern for his colleagues; characteristics we would encourage in all new graduates and celebrate in the renaming of this award.

And so it is with great pleasure we award the Alistair Devlin Australian and New Zealand Prize in Paediatric Dentistry Prize in Paediatric Dentistry to Scott Minson."

*Dr Carmel Lloyd*



## Western Australia Branch

The W.A. Branch has a new President for 2011, Dr Carmel Lloyd, and she and her Committee have set up a program for the year which follows the tried and tested model of the last couple of years.

The first meeting of the year will be a repeat of the very successful "Dinner With Partners" meeting, convened by Dr Peter Readman and held for the first time in 2010. Once again, the exclusive Opus at the Richardson Restaurant in West Perth will be the venue, but the Committee has decided on a completely non-dental topic for the after dinner talk. It will be delivered by a Garden Historian, Mrs Gillian Lilleyman. Her chosen topic is to be the "Gardens of the University of Western Australia". Apart from being the alma mater for the vast majority of the branch members, the University is celebrating its centenary year in 2011. Not that it has been located at the current site for all that time – the original University was in Irwin Street in the city, and the move to the Crawley campus occurred between 1925 and 1932.

The annual mid-winter meeting will be held at the Bunker Bay Resort which is located in the south west of the state, quite close to Cape Naturaliste at the western end of Geographe Bay. The same format will be employed with presentations on the Friday afternoon (29th July), a dinner that evening followed by presentations on the Saturday morning.

The third meeting for the year will be a full day course, conducted in association with the WA Branch of the Australian Society of Endodontology. The day will be devoted to Dental Trauma. The plan for the day is to take a multi-disciplinary approach, with presentations from not only paediatric dental and endodontic presenters but also from periodontic and prosthodontics presenters. A similar meeting with the same collaboration between ANZSPD and ASE was held on this same topic over 25 years ago. That course proved to be the best attended continuing dental education course in Perth up until that time, A.D.A. Congresses excepted. Course Convenor, Dr Yee Sang Welten is expecting something similar this time around.

The final meeting of the year will be the Annual General Meeting and Dinner. The special guest on that occasion will be Professor David Manton from Melbourne. A late night is anticipated!

Paediatric dentistry in Western Australia is about to receive quite a boost with the recent appointment to the newly created Chair of Paediatric Dentistry at the University of Western Australia of Professor Nigel King. Professor King will be well known to many of you as a regular attendee at paediatric dental meetings in Australia and New Zealand, but also as the current President of the Australasian Academy of Paediatric Dentistry Inc. He will be moving to Perth from Hong Kong in August or September.

*Alistair Devlin*

## New South Wales Branch

The ANZSPD NSW Branch held their first meeting for 2011 on the 11th of March at the ADA NSW Centre for Professional Development in St. Leonards. Instead of the usual dinner meeting, we had a well attended half day seminar titled Medical and Dental updates.

The medical lectures were presented by specialists from the Children's Hospital at Westmead. Dr. Peter Barclay spoke about the medications used for the control of excessive saliva production in children. We also had an informative lecture on recognising a sick/unwell child in clinical practice, presented by Dr. Ken Peacock. A/Prof. Craig Munns gave an update on bisphosphonates and problems that can occur with their use in children. The diagnosis and treatment of oro-facial infections in paediatrics was presented by A/Prof. Alison Kesson.

Prof. Elizabeth Martin presented up to date research on the different restorative materials used in paediatric dentistry and an update on dentin bonding with a focus on the primary dentition. Prof. Martin's presentation was particularly interesting as it encouraged a lot of questions and input from our members.

The AGM and elections for office bearers were held on the 11th of March. Members of the committee include A/Prof Richard Widmer (President), Dr. Charles Daniels (Treasurer), Dr. Anna Marie Sanares and Dr. Rebecca Eggers (Secretary) and Dr. Ronny Marks.

The committee is now busy organising the dinner meetings for the rest of the year to be held on the following dates: 10th May, 19th July and 25th October. The ANZSPD NSW Branch committee and members look forward to another exciting and productive year.

*Dr Anna Marie Sanares*



## South Australian Branch

At our Committee Meeting on 23rd November 2010 it was decided that we keep the Committee the same for 2011 and this would allow a degree of continuity to address issues as they arise to make Uluru a reasonable smooth operation.

This year we will have four dinner meetings at:

### 1. The Spice Kitchen – 12/02/11

- Early Orthodontic Intervention, a dilemma", Dr John Cameron
- "Sudden Arrhythmic Death Syndrome", Dr Joe Verco
- Postgraduate Presentation

### 2. Oriental Hotel – 10/05/11

- "Early Childhood Obesity"
- Postgraduate Presentation

### 3. The Rising Sun – 02/08/11

- "Pharmacology – A Clinical Update"
- Postgraduate Presentation

### 4. The Adelaide Club

- "What's new under the Plaque/ Tooth Ware" Dr John Kaidonis
- Postgraduate Presentation

Currently, the Committee has reset the membership at \$280.00 for State and Federal membership and concessional rates for Postgraduate students.

The Sudden Arrhythmic Death Syndrome (SADS) aka "Long Q-T" Syndrome is yet in the press again (Mar 2011) with another young adult death after football and an athlete on "Australian Story" having survived and being put on a cardioverter defibrillator. A Support Group for SADS has started in Brisbane (July 2010). There are still 8-10 deaths per week in Australia.

The Salient features are:

- Long Q-T varies with heart rate.
- There are 300 different variants.
- Four Chromosomes may be linked to this electrical malfunction
- Early recognition is essential in the 5-25 age group.
- Triggers in dentistry are stress/sound/light

In the sporting field it is cardiac stress. However, some can die in their sleep LQT3

- Most respond to  $\beta$  Blockers, rest require pacemakers, cardioverter defibrillation or surgery to the sympathetic nerve.
- 30-40% of deaths are at the first event in "asymptomatic patients"
- Ave age of death for LQT1 63% at 9 yrs; LQT2 46% 12 yrs; LQT3 18% 16 yrs.

## ULURU

Overall the Biennial RK Hall Visiting Lecture series has been turned on its head for 2011. It was decided that the membership travel instead of the Guest Lecturer and were a function to be held in the Centre of Australia – everyone would find it equally difficult to get to! Also it is the 100th Year of existence of The Northern Territory and its emblem the "Territory Rose" is 50 years old!

I am most grateful to Colleagues and Editors in the rest of the world for assisting in the dissemination of our material. EAPD in giving us a half colour page in their Journal; Am APD in putting us in their E-News, RACDS for their E-News and IAPD for the links in E-News.

I am upset that we had to pay to get into Dental Insights (ADA/SA Branch Inc.). Alas, it is always tougher in our own backyard.

Currently, we have in excess of the 70 "early bird registrations" (Dentists 38). Thanks to our Advertising and

the recent visit from "Oprah" from the USA we now have delegates from America – Texas, Alaska etc; Canada, Germany and Hong Kong.

The Visiting Lecturer Prof Joel Berg is very much looking forward to seeing the Centre of Australia, and we have organized a Pre-Conference tour of Alice Springs (Mon 22nd Aug noon – Wed 24th Aug noon) before Uluru. We hope to cover the RFDS, School of the Air, Cultural Centre and the Overland Telegraph Station as well as Glen Helen, Ormiston Gorge and an "included balloon flight".

The minimum of 12 has been reached and we can take additional delegates.

We are also grateful to A/Professor Roger Hall, incoming IAPD President Dr Eduardo Alcaino, and most recent recipient of an Australian Award for outstanding Service to Dentistry, Dr Jamie Robertson for giving talks in Uluru.

We have also decided to try and accommodate 20 hours of CPD points. There has been concern that some lectures would be more heavily weighted than others – but so far this not the case. We will finalize the Programme in March/April.

However, we do not wish to lose sight of the atmosphere of Uluru with the Rock, Katajuta (the Olga's) the Sounds of Silence Dinner and the Valley of the Winds. The year 2011 will probably be The Best for decades as the Outback has received a drenching with rain over summer and it continues!

I do thank all of the Committee for their enthusiasm and help with ideas for the Monthly Missives which have been hugely successful with those from overseas.

Joe Verco

## QLD Branch

ANZSPD QLD Branch has seen many changes in 2010. These include new members, plenty of guests to dinner lecture meetings, a big change in venue at the fabulous SeaSalt Restaurant as well as a well overdue increase in membership fee and the introduction of CPD points for members and guests attending lectures.

We had fantastic speakers to the Society's meetings and Clinic Day including Professor Monty Duggal, Professor Nigel King, Professor Hien Ngo, Dr Rod Marshall and Dr Peter Wong, the invited guest speaker for our Clinic Day. We saw record attendance for our Clinic Day of 105 attendees, sponsored by Henry Schein Halas and held at the lovely Indooroopilly Gold Club. Sponsors of the Society's

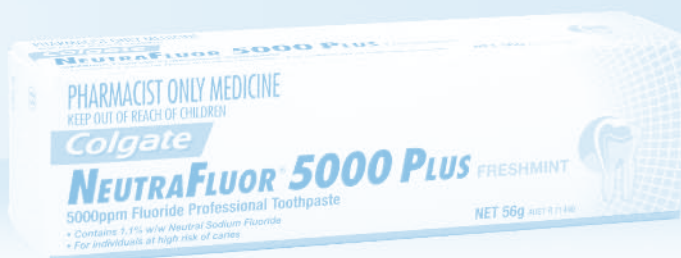
meetings were 3M, ESPE and Colgate whom we are sincerely appreciative of for their support. Topics covered in 2010 include Remineralization and demineralization, Trauma to immature permanent incisors, Periodontal problems in children and Treatment planning for the paediatric patient.

Matthew Fracaro



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by Sue Cartwright



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The gingival tissues around implants become inflamed by plaque biofilm similar to around teeth and 80% of patients with dental implants develop peri-implant mucositis (3). A randomised double-blind, parallel-group study was conducted with 59 patients who had at least 2 implants and at least 1 site with bleeding on probing as a symptom of perio-implant mucositis. These patients brushed twice daily with Colgate Total or regular fluoride toothpaste. Results showed that gingival inflammation was significantly reduced in sites with dental implants when brushed with Colgate Total compared to regular fluoride toothpaste ( $p < 0.001$ ) (4).

So does toothpaste improve oral health? Evidence shows the answer is a resounding YES – in particular when triclosan copolymer toothpaste such as Colgate Total is used.



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## Australia and New Zealand Society of Paediatric Dentistry www.anzspd.org.au

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### Submissions

All text for inclusion in Synopses must be submitted to the editor on CD or by email. Media will not be returned. Address email to timjohnston@westnet.com.au. Please enclose your contact details and email address with all submissions.

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